Cumulative excess deaths in New Zealand in the COVID-19 era: biases from ignoring changes in population growth rates

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Cumulative excess deaths in New Zealand in the COVID-19 era: biases from ignoring changes in population growth rates

John Gibson

Department of Economics, University of Waikato, Hamilton, New Zealand

ABSTRACT

Accurate health and economic data are needed to evaluate policy responses to COVID-19. A potentially comprehensive health indicator is excess deaths. Local commentators highlight an excess deaths series that suggests negative cumulative excess mortality for New Zealand in the first three years of COVID-19 – in other words, fewer deaths than expected. This flawed measure ignores changes in population growth. Deaths rose in New Zealand from 2015 to 2019 as population grew at two percent per annum. Population growth came almost to a standstill after the border closed in March 2020. Methods of extrapolating from the past to predict future deaths, to ascertain if actual deaths exceed projections, must account for this sharp change in population growth rates. Rather than New Zealand being unique, in having negative cumulative excess deaths in the COVID-19 era, cumulative deaths are about four percent above expected deaths (through 2022) once population growth rate changes are accounted for.

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1. Introduction

Evaluation of New Zealand's policy response to COVID-19, which involved border closures, lockdowns, mask and vaccine mandates and costly monetary and fiscal stimuli, requires accurate health and economic data. The notion of 'excess deaths' – the gap between all-cause deaths and the deaths to be expected under normal circumstances – is a comprehensive health indicator. If interventions reduce some deaths but increase others, excess deaths show the net effect. However, there is no consensus on how to estimate expected deaths; some studies use a simple mean of deaths in a prior 5-year period, others extrapolate from that prior period using a time trend, some allow for population changes, while others base analyses on death rates (so population changes are eventually needed to convert back into death numbers).

Public health commentators have recently highlighted a particular measure of excess deaths that seemingly shows negative cumulative excess mortality for New Zealand in the first three years of the COVID-19 era – in other words, fewer deaths than expected. Three examples of these claims, made at several points during 2023, are:

- in an article in *New Zealand Doctor* the former executive director of the Association of Salaried Medical Specialists presents a chart of cumulative excess deaths per million from January 2020 to January 2023, for 23 countries (mainly from the OECD) and claimed that 'of the 23 countries, New Zealand is the only one not to have an excess of death rate at all (under 0 to be precise)'

CONTACT John Gibson jkgibson@waikato.ac.nz Department of Economics, University of Waikato, Hamilton 3240, New Zealand

and went on to infer that this was due to the success of local public health measures based on an elimination strategy (as opposed to a mitigation approach) for dealing with SARS-CoV-2 (Powell, 2023).

- in an interview on the third anniversary of the first lockdown, former director-general of health Sir Ashley Bloomfield said he was greatly satisfied that, three years on, New Zealand still had negative excess mortality. He argued, 'we had less deaths than you would have predicted based on the previous years … [which] … is unique, virtually unique around the world' (Olley, 2023).
- in a viewpoint article in the *New Zealand Medical Journal*, Baker *et al.* (2023) present a chart of cumulative excess deaths per million from 2020 to mid-2023 to support their claim of 'cumulative excess mortality in New Zealand from January 2020 to June 2023 remains close to zero' and they also include nine other rich countries in the chart (one is Australia) for whom cumulative excess mortality by 2023 appears to be at least 1000 deaths per million people. They conclude that New Zealand's COVID-19 pandemic response has been among the world's most effective, and that the greatest lesson is that an elimination strategy (or ideally exclusion) should be the default first choice for future pandemics.

The measure that underpins all three examples is from Our World in Data (OWID): 'Excess mortality: Cumulative deaths from all causes compared to projection based on previous years' which is based on estimates originally made by Karlinsky and Kobak [hereafter, K&K] (2021).[1]

The emphasis placed on this particular measure of excess mortality extends beyond the public health commentariat and appears to have informed views of politicians and media. For example, in a radio interview in May 2023, the leader of the ACT Party, David Seymour MP, responded to a question about excess deaths by stating: 'over the last three years, in Our World in Data put together by the University of Oxford, New Zealand still has negative excess deaths'.[2] Similarly, in a pre-election article on the www.interest.co.nz financial news website, the journalist Dan Brunskill refers to New Zealand's 'best in class health performance during the pandemic' with a link to an opinion piece in the Bloomberg financial magazine that uses the OWID series from K&K (2021) to show New Zealand as just one of four countries with negative cumulative excess deaths during the COVID-19 era.[3] Numerous other examples can be provided of direct and indirect ways that the K&K (2021) projection-based excess death estimates continue to shape the local debate about New Zealand's pandemic response.

Yet there is surprisingly little critical appraisal of this projection-based approach in the local commentary. The K&K measure is badly flawed for the New Zealand context because it ignores the changes in the population growth rate. Expected deaths are simply based on a trend extrapolation from 2015 to 2019, when deaths in New Zealand were rising fast, at 2.05% per year, due largely to population also rising fast, at 1.94% per year. Population growth came almost to a standstill after the border was closed in March 2020 but the K&K projection ignores that change and so it keeps on predicting a fast rising number of deaths, which provides a distorted benchmark for comparing with actual deaths in order to ascertain if there is excess mortality. Other measures of excess mortality that are equally easily available (indeed, some also from OWID) and that even are from sources that are the precursors to the K&K projections (and that have their own rich menu of projection options) do not have this particular flaw but are routinely ignored in the New Zealand discussions.

2. Sensitivity of excess mortality estimates to various population assumptions

Figure 1 provides visual evidence on the very different patterns seen in some readily available excess deaths measures for New Zealand. The charts in panel (a) and (b) are from OWID. The online tools there enable easy reproduction of what is displayed here (except the cumulative mean in (b), which takes some further calculations). Panel (a) has cumulative all-cause deaths compared to projection, per million of population. This is based on K&K (2021), and it seems lower by the end of 2022 than at the start of 2020, and is below zero throughout; aligning with the statements by public health, media and political figures in the examples given above.

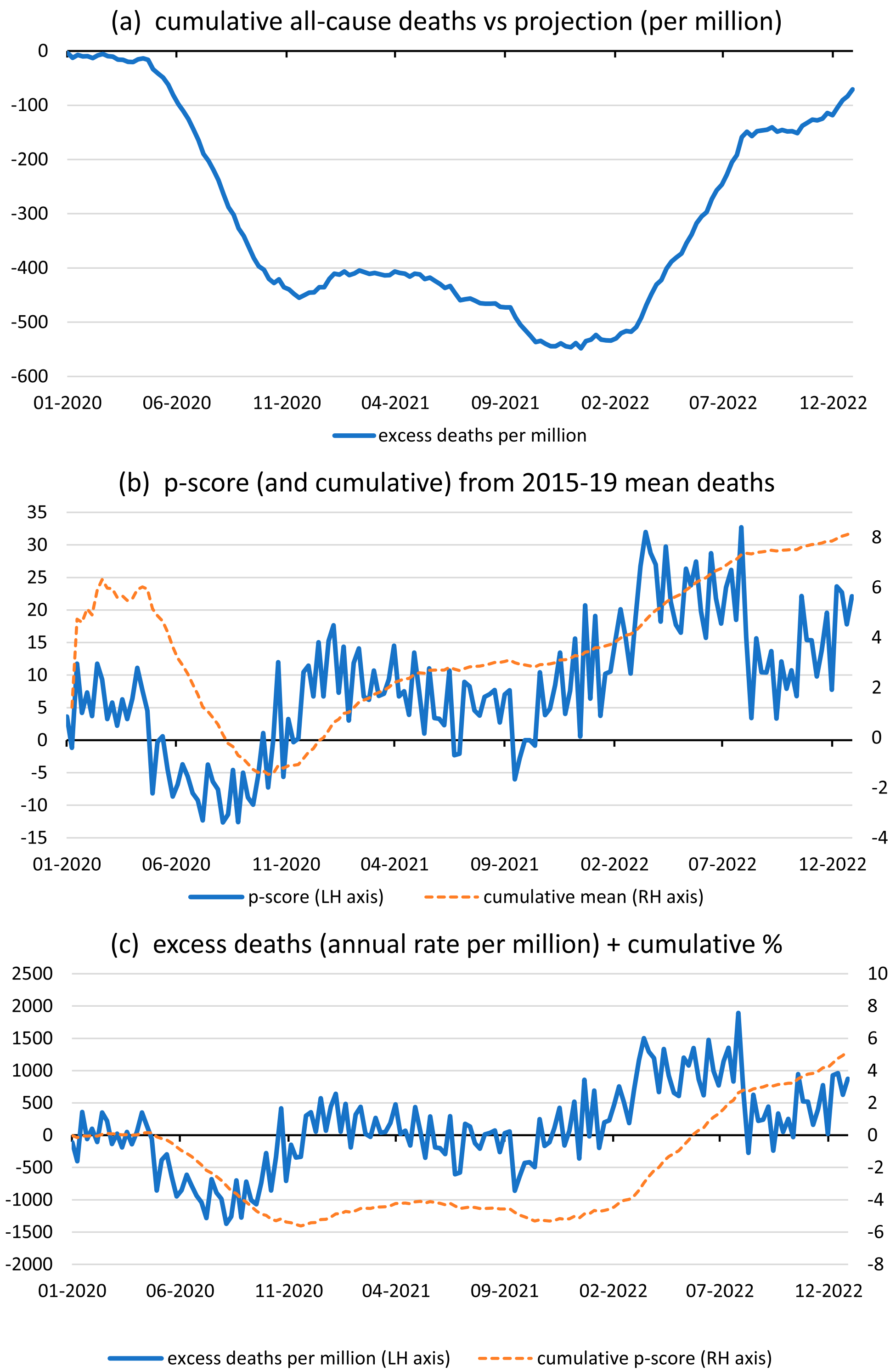

Figure 1. Three depictions of excess mortality in New Zealand in the COVID-19 era.

The pattern in the panel (b) chart is very different. This shows 'p-scores using five-year average baseline' which is the percentage by which deaths in any particular week of 2020–22 differ from the 2015–19 average number of deaths in that same week of the year. For example, week 32 (early August) of 2020 had 643 deaths; 12.6% below mean deaths for week 32 in the 2015–19 period. At the other extreme, week 31 of 2022 had 967 deaths, which is 32.7% above the mean for week 31 from 2015 to 2019. The cumulative mean of these p-scores was 8.2% by the end of 2022. In other words, the first three years of the COVID-19 era had 8.2% more deaths than mean annual deaths from 2015 to 2019; roughly 8000 more deaths in three years, given the 2015–19 mean of 32,800 deaths per year. Of course, an obvious rebuttal to this calculation is that population in 2020–22 is higher than in 2015–19 so more deaths should be expected (but it was not 8.2% higher, as discussed below). Moreover, the series in panel (b) is from OWID (the link for this series is next to the link for the panel (a) series on the OWID screen) and so one would expect it to either get similar consideration to the panel (a) series or else to feature in explanations by commentators on which series is more suitable. Those explanations have not occurred. Instead alternatives to the panel (a) series are not discussed and the justification for using the K&K series seems to be along the lines of it being from the University of Oxford, so it must be correct (the presence of series (b), also from Oxford, invalidates this argument).

The chart in panel (c) is from the Human Mortality Database (HMD), a joint initiative of UC Berkeley and the Max Planck Institute for Demographic Research that predates OWID by a decade. The Short-Term Mortality Fluctuations (STMF) visualization toolkit (Németh, Jdanov, & Shkolnikov, 2021) provides HMD weekly data on deaths, and death rates, for five age-groups, separately for males and females. The toolkit provides six ways to create reference data on expected deaths (week-specific means, trends or lower quartiles and annual and summer counterparts to these), and gives users full flexibility over reference periods (from 2010 onwards for New Zealand). Remarkably K&K (2021) use HMD weekly deaths for New Zealand (plus 28 other countries) as the basis for their extrapolation from 2015 to 2019, while ignoring all of the other details.

In other words, to create the series in panel (a), K&K (2021) ignored the rich variation in the HMD database, and used the coarsest indicator – the weekly death counts – to extrapolate with a linear trend into the COVID-19 era, without allowance for changes in population growth rates from the baseline 2015–19 period. Meanwhile, the STMF toolkit includes several series based on death rates that already allow for population changes. Putting issues of provenance to one side, what does the chart in panel (c) show? From May 2020 to October 2020 there was a mortality deficit, at a peak rate of −1350 per million in early August (this rate annualizes the gap between the actual and expected death rates in each week). The next 12-months had a slight rebound in excess mortality, with the cumulative p-score rising from −5.6% to −4.4% and then there was a short, sharp mortality deficit in September and October 2021 (perhaps associated with the 'Delta lockdown'). The next ten months saw a sharp upward trend, culminating with excess death rates of 1900 per million by late July 2022 and staying above zero for most of the rest of that year. In terms of the cumulative p-score, this became positive by May 2022, many months before commentators claimed that cumulative excess mortality was still negative three years into the COVID-19 era. By the end of 2022, the cumulative p-score is about five percent; the difference between this value and the cumulative p-score in panel (b) is one indirect way to see effects of population growth, as population growth is ignored in panel (b) but is indirectly allowed for (by using death rates rather than death counts) in panel (c).

Differences between the excess mortality estimates also show up over shorter timespans that may be salient to future attempts to evaluate policy interventions. Consider the five-month period from 19 September 2021 to 20 February 2022. With the K&K projection-based approach in panel (a), cumulative excess deaths went from −491 per million to −516 per million; showing an ongoing mortality deficit. The panel (b) and (c) charts show a very different picture of this five-month period. The panel (b) p-score rose from −6 to +16; with trend rate of increase of 0.8 per week (the Newey-West heteroscedasticity and autocorrelation consistent (HAC) standard error is 0.1). Compared to the 2015–19 baseline of mean deaths per week, this five-month period saw 1140 excess deaths. In panel (c), based on death rates, this five-month period saw a trend rate of increase of 50 per week (with a HAC standard error of 8.1), in terms of annual excess deaths per million. A contributor to these differences is the assumption about population growth embedded in the K&K projection approach; the population was static from September quarter 2021 (5,115,000) to March quarter 2022 (5,114,900) yet the K&K projection approach implicitly assumes population growth of 55,000 in this period. This assumed population growth is hand-in-hand with projected deaths rising, so the actual rise in deaths in these five months does not seem to be in excess of this rapidly inflating baseline in the panel (a) chart.

Two questions are raised by the charts in Figure 1, and especially the contrast between the patterns of excess mortality in panel (a) compared to panel (c). First, *what* accounts for the differences? Second, *why* did the public health commentariat and others coalesce around the K&K projection-based estimates rather than using the far richer menu of choices in the STMF visualization toolkit, whose data are actually a precursor to the K&K series? The answer to the *what* question has already been hinted at, in terms of a failure of the K&K approach to deal with changes in population growth rates, and this is shown more formally in the next section. The *why* question is mainly left for future historians of New Zealand's response to COVID-19 but the Conclusions discuss one aspect of disciplinary culture that relates to this question.

3. Evidence on the bias from ignoring changes in population growth rates

Karlinsky and Kobak (2021) obtained data from various sources on all-cause deaths from 2015 onwards for 103 countries. In addition to their journal article, they maintain a GitHub site (https://github.com/dkobak/excess-mortality) that now has data for 127 countries and continues to update the estimates. The deaths data for New Zealand, along with for 28 other mostly OECD countries, are just the weekly all-ages total deaths from 2015 onwards from the Human Mortality Database (ignoring the many other details that HMD has). For other countries the deaths data are from various other sources, and may be weekly, monthly or quarterly. For the countries with weekly data K&K forecast expected deaths after 2019 with this regression:

$$D_{w,T} = \delta_w + \beta \cdot T + \varepsilon \quad (1)$$

where $D_{w,T}$ is deaths in week w of year T from 2015 to 2019, δ_w is a set of fixed effects for each week of the year, T is a linear time trend (2015 = 1, 2016 = 2 and so on) and ε is a random error. The K&K estimate of excess deaths is simply the difference between actual deaths, from 2020 onwards, and the predicted number of deaths using Equation (1). Their purpose in making these calculations was to have a more 'objective' indicator of the COVID-19 death toll. For the few countries (including New Zealand) with actual deaths post-2020 below the Equation (1) forecast (data for their journal article is to 6 June 2021 for New Zealand) they claim (p.1) that it was 'due to social distancing measures decreasing the non-COVID infectious mortality'.

There is no discussion in K&K (2021) of why Equation (1) should accurately forecast expected deaths. They just claim that there is a 'yearly trend over recent years due to changing population structure or socio-economic factors' (p.14) which is rather vague. For example, while deaths rose in New Zealand during 2015–19 it was not a smooth increase, with two of the four annual differences (2016 versus 2015, and 2018 versus 2017) having falls rather than rises. There also is no discussion of the value-added in their estimates compared to the STMF ones that let users project using trends (or means), for total deaths and death rates, for ten age-gender groups. The only adjustments that K&K (2021) make to their estimates are for Armenia and Azerbaijan to account for deaths from the 2020 Nagorno-Karabakh war.

A flaw in the K&K (2021) estimates is that Equation (1) lacks a population variable, so whatever the population growth rate was from 2015 to 2019 is implicitly projected forward at the same rate into the future. Assuming that population growth continues to follow the trend is poorly suited to the New Zealand context of migration-induced changes in population growth. Figure 2 shows resident population each quarter from the beginning of 2015 until the end of 2022.[4] The population growth

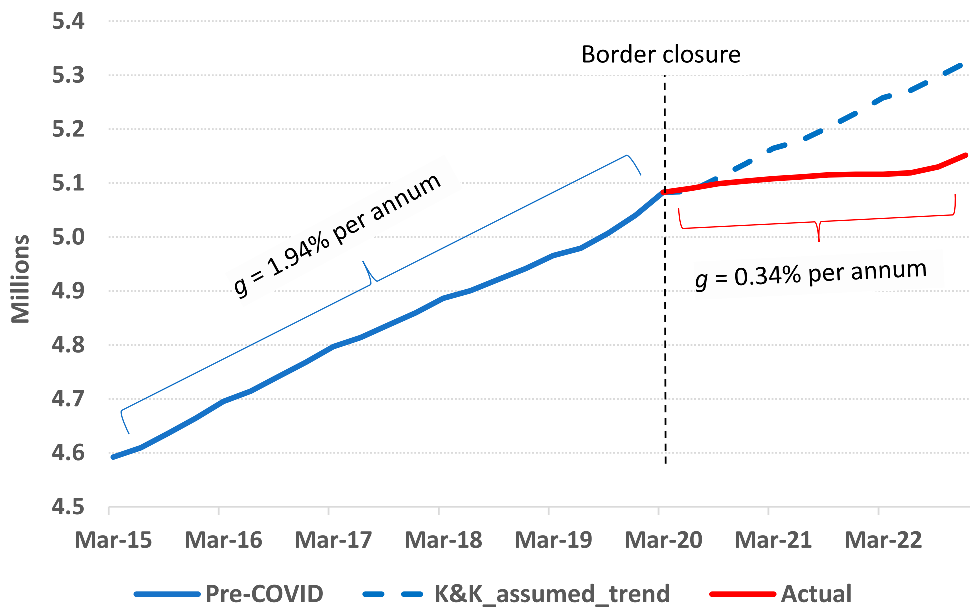

Figure 2. New Zealand resident population: actual and K&K assumed trend.

rate fell sharply from March 2020 after closing the border; instead of 1.9% per annum the growth rate fell to just 0.3% per annum. By the end of 2022 the K&K approach assumes an extrapolated population that is 0.17 million above New Zealand's actual population then. Using the average death rate in 2022, this exaggerated population yields 1290 more 'expected' deaths that year than the actual population would warrant. This error grows over time: at the end of 2021 the K&K assumed trend population was 0.11 million above actual population, overstating expected deaths that year by 850 while at the end of 2020 the overstatement of population (expected deaths) was only 0.03 million (240). For the claims about cumulative excess mortality, these errors accumulate over time.

A conceptually superior approach to that used by K&K (2021) is to include population in the regression that forecasts the total number of expected deaths each week, as in:[5]

$$D_{w,T} = \delta_w + \beta \cdot T + \gamma \cdot Pop + \varepsilon \quad (2)$$

where the other variables are as defined for Equation (1) and *Pop* is a population indicator. If the Statistics New Zealand quarterly resident population estimates (from the footnote #4 link) are used, the null hypothesis that $\gamma = 0$ is rejected: $F_{1,363} = 77.4$ ($p < 0.001$). Another way to get population estimates is to note that the HMD provides both weekly total deaths and death rates, so a population estimate is embedded in the death rates and can be backed out from the ratio of the two values. The advantage of using HMD data is that they are also available for the other 35 counties in that database, and by estimating Equation (2) for each of these countries we can see whether excluding population matters especially for New Zealand. The *F*-test for excluding this HMD population series, when predicting New Zealand deaths, is $F_{1,363} = 74.9$ ($p < 0.001$). Only two other HMD countries have larger effects of excluding population. In other words, New Zealand is one of the countries for which it is least sensible to use the K&K approach of projecting deaths into the future with no adjustment for changes in population growth rates.

In addition to using population as an extra predictor, the age structure could be used.[6] A surprising result for New Zealand in the period prior to COVID-19 is that a growing share of the population in older age groups (e.g. the 65 years and above share rose from 18.5% in 2015 to 19.5% in 2019) did not cause a rise in the overall death rate. This is due to *within* age group death rates falling, to offset between group movements into age groups at greater risk of death. The 2015 to 19 period (that K&K use) has an annual trend in death rates of 0.1% and for the longest period with HMD weekly death rates available (2011–19) the trend is zero. Yet for the same periods the total deaths rose by 2.1% per year (2015–19) or 1.7% per year (2011–19). The driving force for rising total deaths, with static death rates, is that a rising population simply meant that more people were available to die. Full details on the trends in deaths and death rates, for all of the age groups and for all-ages, are reported in Appendix A. Given these results in the appendix, supplementing Equation (2) with age-group shares seems unnecessary.

4. Policy implications

The K&K (2021) measure of excess deaths that ignores changes in population growth rates may skew policy discussion in at least three ways. First, complacency about increased deaths may occur because some of the rise may seem 'expected' due to using a population projection that is too high. For example, New Zealand recorded 3640 more deaths in 2022 than in 2021 – a rise of 10.4% – Statistics New Zealand attributed the rise to COVID-19 and population aging (Gabel & Knox, 2023). Yet net effects of aging are more complex, as Appendix A shows, and aging did not cause overall death rates to rise prior to the COVID-19 era. The attribution of the extra deaths in 2022 to COVID-19 also cannot be the full story as fewer than 2700 deaths were attributed to COVID-19 over the first three years.[7] Thus, approximately 1000 extra deaths in 2022 are likely to be from causes other than COVID-19 but little interest is seen in questioning these non-COVID deaths. Notably, the exaggerated population in 2022 implied by the K&K approach (as in Figure 2) equates to 1290 more annual deaths than actual population would indicate; an error equivalent to more than one-third of the year-on-year increase in deaths. In other words, the upwardly biased K&K population projections make it seem that much of what was actually an unprecedented rise in deaths in 2022 was, on the contrary, to be expected, giving the impression that there is little that is unusual to see here.

Second, once it is acknowledged that New Zealand has experienced excess mortality it becomes important to correctly date occurrences to help find the possible causes. For example, if the sharp rise in excess deaths in the five months after September 2021 (as seen in panels (b) and (c) of Figure 1) was some sort of rebound or mean-reversion following a short suppression of deaths during the 'Delta lockdown' then it is important data for evaluating the sustainability of lockdowns. This is especially because public health commentators continue to advocate for lockdowns as a tool for the future (Baker *et al.*, 2023; Olley, 2023). Notably, the K&K projection approach disguises the rise in deaths in the five months after September 2021, as panel (a) of Figure 1 shows, and so by misdating excess mortality it may obscure the causes.[8]

The third way that use of the K&K projection-based excess deaths measure may distort local policy discussion is when comparisons are made to outcomes in other countries; usually such comparisons can help to prompt some reflective critique of local policy responses. Yet the claims by commentators of New Zealand's unique negative cumulative excess mortality during the first three years of COVID-19 are likely to suppress such critique and lead to more of a self-satisfied 'didn't we do well' perspective. Some evidence for this comes through in the phrases used in media articles such as 'New Zealand got it right with COVID-19 response' (Olley, 2023). A similar claim is the 'best in class health performance during the pandemic' by the journalist Dan Brunskill referred to in footnote #3. While people in other countries can clearly see their own cumulative excess death tolls and so may therefore ask sharper questions of what was gained (and what was lost) by novel interventions such as lockdowns there seems to be less appetite for raising similar questions in New Zealand. One reason may be that a misleading statistic is helping to lull the population into a false sense that our policy response was one of the best in the world.

To show the difference that is made to cross-country comparisons by failing to account for the changes in population growth rates, Figure 3 shows p-scores for cumulative excess mortality for the 2020–22 period. The data are for the 36 countries (including New Zealand) with weekly deaths

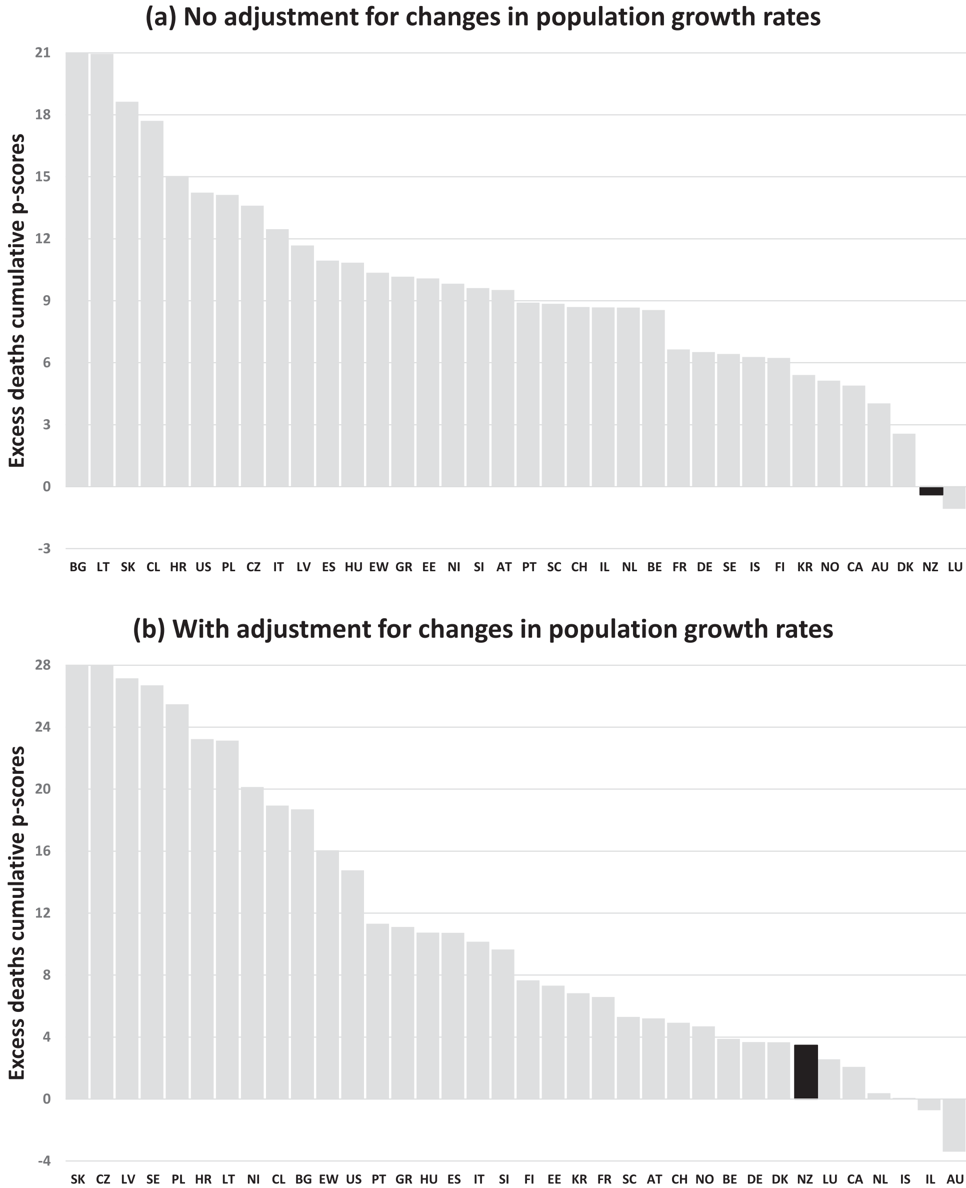

Figure 3. Cumulative p-scores, with and without, population adjustment.

data for 2015–22 in the HMD. Countries are designated by their two-letter ISO code (see here: https://en.wikipedia.org/wiki/List_of_ISO_3166_country_codes) except England and Wales (EW), Scotland (SC), and Northern Ireland (NI) who each have HMD data but do not have their own (sub-national) ISO codes. In panel (a) the excess mortality p-scores are based on Equation (1), from the K&K approach, with a time trend that ignores changes in population growth rates. In line with panel (a) of Figure 1, the p-score for New Zealand is negative, suggesting that there were fewer deaths than expected over the 2020–22 period. Likewise, in line with the claims by commentators, New Zealand seems to be one of just two countries to have this negative cumulative excess mortality (Luxembourg is the other).

Yet once the lower population growth rate from March 2020 is allowed for in panel (b), using the Equation (2) regression that controls for population, the apparent negative cumulative excess mortality in New Zealand over the 2020–22 period disappears. Instead, we are amongst a group of four countries (the others being Denmark, Germany and Belgium) with cumulative p-scores just below four percent.[9] There are a further six countries (Luxembourg, Canada, the Netherlands, Iceland, Israel and Australia) that have even lower (negative for some) cumulative p-scores.

There is a further reason for caution in making claims about New Zealand's uniquely negative cumulative excess deaths during the first three years of the COVID-19 era. There is statistical uncertainty in excess deaths estimates. To reduce clutter the bars in Figure 3 do not have confidence intervals shown, but New Zealand's cumulative p-score has a standard error of 0.9 and a 95% confidence interval from 1.7% to 5.3%. In fact, t-tests suggest that one has to go eight countries to the left of New Zealand, amongst the Figure 3(b) bars, to find the first country (France, FR) with a statistically significant ($p < 0.05$) higher cumulative p-score. In other words, the group of countries from Scotland through to Denmark in Figure 3(b) all have p-scores that are statistically indistinguishable from New Zealand's p-score, even though they have slightly higher point estimates. While one can claim that New Zealand is in the lower half of the countries in Figure 3(b) the data do not allow much beyond that.

5. Conclusions

Accurate health data are needed to evaluate responses to COVID-19. Local media, politicians and public health commentators have coalesced around a projection-based measure of excess deaths due to Karlinsky and Kobak (2021) that seemingly shows negative cumulative excess mortality for New Zealand in the first three years of COVID-19. This measure poorly suits the New Zealand context because it ignores the sharp fall in population growth rates after the border was closed in March 2020. Deaths (but not death rates) had risen sharply pre-COVID, alongside rapid population growth, and the projection-based method simply extrapolates that trend forward. Hence, a rising number of 'expected' deaths makes the actual rise in deaths in the post-2020 period seem less remarkable. To correct this flaw in the projections, population is included as a predictor and this shows that cumulative excess mortality for New Zealand was roughly four percent over the first three years of COVID-19; approximately 4000 excess deaths. This is similar to what is shown by measures of excess mortality based on death *rates* (such as in Figure 1(c)) that are readily available online and that show that cumulative excess deaths for New Zealand had already moved well into positive territory by mid-2022.

My final conclusion concerns disciplinary differences in research culture. It is offered to prompt thinking on the *why* question, of public health commentators coalescing around K&K projection-based excess mortality estimates rather than HMD ones that use death rates and that clearly showed positive cumulative excess mortality from mid-2022 onwards, as Figure 1(c) shows. Peer review in economics is adversarial, conditioning economists to build in responses to likely criticisms from the outset. Public health seems more collegial; reviews are faster and lighter and author teams larger (internalizing different views). For example, Baker *et al.* (2023) has 15 authors. If economists were more prominent in the public square in the COVID-era, it may more quickly have become apparent that claimed negative cumulative excess mortality was just an artefact of an inappropriate way to predict expected deaths in a country with a fluctuating population growth rate. With our obsession for robustness tests and sensitivity analyses, the odds of data from the same source (OWID) or an upstream source (HMD) that showed different patterns of excess mortality remaining undisclosed would have been lower and flaws in the K&K approach might have been brought to light more quickly.

These disciplinary differences usually don't matter. No one discipline has a monopoly on the best way to find truth. But it matters this time because New Zealand lacks checks and balances. A few cabinet ministers, perhaps just the Prime Minister, can change the course of the country, with no subnational variation or second chamber debates to see (at least *ex post*) if the changes helped. For example, in the United States, Florida's Surgeon-General advocates against mod-RNA vaccines due to their DNA contamination and the Texas Attorney General is suing Pfizer for misleading claims about the vaccines.[10] Yet officials in other states, such as California, have strong views in the other direction, and so out of this contest we eventually may learn something (just as the differing state and county approaches to lockdowns yielded counterfactuals used by Gibson (2022)). In contrast, policy making and implementation in New Zealand is much more monolithic, making it especially important to promote a contest of ideas from different disciplines before the decisions made by politicians are embedded.

5.1. Postscript

The initial version of this paper was written in May 2023, prompted by claims from public health commentators and politicians that cumulative excess deaths were still negative. By the time of the revisions in December, 2023, the rebound in New Zealand's net inward migration had become apparent. The charts in the main part of the paper have not been updated, in order to show patterns using information available in mid-2023 when the claims about cumulative negative excess deaths were being made. So a natural question therefore arises as to whether an update with 2023 data would alter the main results. The short answer is that it would not.

For example, Figure 2 on overstating implied population in the K&K projection-based approach still holds. Statistics New Zealand currently reports resident population estimates to the end of September 2023 (5.27 million). In contrast, the K&K projection approach implies that the population was 5.42 million by then, overstating actual population by 0.15 million. Using the 2022 death rate, the upward bias in estimated baseline population for 2023 leads to the 'expected' deaths that year being 1170 too high, serving to downplay the significance of ongoing excess mortality in 2023.

In terms of just how many excess deaths there were in 2023, the reporting of deaths in December 2023 is not yet complete. However, it seems that just four weeks (in August) had a mortality deficit (so there likely will be 48 weeks with excess mortality), based on comparing to death rates in the same weeks of 2015–2019. The excess mortality rate for the year to date is averaging just over eight percent; corresponding to about 3000 more deaths than would be expected. Hence, the overstated expected deaths from using the K&K projection-based method will be more than one-third of the excess deaths for 2023, similar to the contribution made by this data artefact in 2022. To the extent that public appreciation of the severity of the excess deaths problem has been delayed and downplayed by commentators coalescing around the misleading K&K-based measure there seems to be more than adequate motivation for future researchers to study the *why* question that I have left largely unexamined.

Notes

1. Data are available here: https://ourworldindata.org/excess-mortality-covid
2. The interview is replayed here: https://realitycheck.radio/david-seymour-on-the-important-issues-of-our-times/ and the claim about negative cumulative excess deaths comes at about the 56 min mark.
3. Available here: https://www.interest.co.nz/economy/124319/new-zealand's-economy-doing-okay-not-enough-win-election with the Bloomberg article available here: https://www.bloomberg.com/graphics/2023-opinion-lessons-learned-from-covid-pandemic-global-comparison/
4. Data are available from: https://www.stats.govt.nz/topics/population
5. An alternative would have been for K&K (2021) to use death *rates* rather than deaths given that HMD weekly data are available both as deaths and death rates. They do not discuss why they ignore the death rates data.
6. Equation (2) might also be supplemented with the foreign-born share if migrants are assumed to have different death rates. But such data are only available with a long delay. Census data show about one-third of arrivals are returning New Zealanders (Stillman & Maré, 2008) who face no age or health limits. Some returnees may age select, given earlier age of superannuation eligibility than overseas and light residency requirements (10 years past age 20, of which 5 are past age 50, including time overseas in Australia, the UK and countries with social security agreements). Consistent with this selection, provisional data for 2014–18 show that the ratio of arrivals to departures in the 60–64 years group was 1.8; far higher than in the adjacent younger (1.3) and older (1.2) ten-year age groups (https://www.stats.govt.nz/news/provisional-migration-estimates-by-age-sex-now-available).

7. https://covid19.govt.nz/news-and-data/covid-19-data-and-statistics/#covid-19-data-portal
8. This sharp rise in deaths cannot be directly from COVID-19. From mid-September 2021 until the start of New Zealand's Omicron outbreak in late January 2022, OWID reports approximately 11,000 cases in New Zealand, including those intercepted at the border. The case-fatality ratio (CFR) of Omicron is 8.3 deaths (within 30 days of a positive PCR test) per 100,000 cases (Erikstrup et al., 2022). Even if the CFR for Delta was triple that, cases from September 2021 until the Omicron outbreak should cause fewer than ten deaths. For Omicron, confirmed cases were below 10,000 in the first month of the outbreak, which corresponds to less than one expected death.
9. This cumulative p-score is similar to, but not identical with the one shown for December 2022 in panel (c) of Figure 1, which is based on death *rates* from HMD weekly data. In the equation (2) (and Figure 3(b)) approach, weekly deaths are the dependent variable in the regression and population is a predictor on the right-hand side. A homogeneity restriction would be needed for the two approaches to yield identical estimates.
10. See: https://www.floridahealth.gov/newsroom/2024/01/20240103-halt-use-covid19-mrna-vaccines.pr.html and https://www.texasattorneygeneral.gov/news/releases/attorney-general-ken-paxton-sues-pfizer-misrepresenting-covid-19-vaccine-efficacy-and-conspiring
11. The reversal of the estimated annual trend, from negative for 2011–19 to positive for 2015–19 in the death rates for the 0–14 years group should not be given too much weight, given that only 1.2% of all deaths are from this age group.

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ORCID

John Gibson http://orcid.org/0000-0003-3886-6873

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Appendix A

Trends in death rates and in deaths, by age group, prior to the COVID-19 era

The Human Mortality Database has weekly deaths data (by date of occurrence) obtained from Statistics New Zealand since week 52 of 2010. The deaths and death rates are disaggregated into five age groups. The data from 2011–19 (468 weeks) are used here to estimate a semi-log equivalent to the Equation (1) specification used by K&K (2021):

$$\ln(D_{w,T}) = \delta_w + \beta \cdot T + \varepsilon \tag{1}$$

Table A1. Age-specific trends in deaths and in death rates.

		Trend annual rate of change (from semi-log regression)			
		2011–2019		2015–2019	
Age Group	% of deaths[a]	Death Rates	Deaths	Death Rates	Deaths
0–14 years	1.2	−0.022	−0.015	0.012	0.023
		(0.002)∗∗	(0.002)∗∗	(0.006)∗	(0.006)∗∗
15–64 years	18.8	−0.005	0.012	0.004	0.023
		(0.002)∗∗	(0.002)∗∗	(0.004)	(0.004)∗∗
65–74 years	16.8	−0.016	0.021	−0.012	0.021
		(0.001)∗∗	(0.001)∗∗	(0.004)∗∗	(0.004)∗∗
75–84 years	27.0	−0.018	0.012	−0.019	0.016
		(0.001)∗∗	(0.001)∗∗	(0.003)∗∗	(0.003)∗∗
85 years and up	36.3	−0.005	0.024	0.000	0.023
		(0.001)∗∗	(0.001)∗∗	(0.003)	(0.003)∗∗
All age groups		0.000	0.017	0.001	0.021
		(0.001)	(0.001)∗∗	(0.002)	(0.002)∗∗
Observations		468	468	260	260

Notes: The trend annual rates of change are estimated from a regression with a logarithmic dependent variable (in either death rates or deaths), weekly dummies, and a time trend. HAC standard errors in (). ∗∗ denotes statistical significance at the 1% level.

where $D_{w,T}$ is deaths in week w of year T (or alternatively, death rates), δ_w is a set of fixed effects for each week of the year, T is a linear time trend ($2011 = 1$, $2012 = 2$ and so on) and ε is a random error. The single week of data from 2010 is ignored, to ensure that all annual values of the time trend are supported by a full year of weekly values. The equation is also estimated on the 2015–19 sample, to match the period used by K&K (2021). The semi-log specification allows the $\hat{\beta}$ to be interpreted as the trend annual rate of change.

For both the 2011–19 period and the 2015–19 period there is no trend in death rates for the all-ages aggregate, which are precisely estimated zeros. Yet there are precisely estimated positive trends in the all-ages total number of deaths, which were rising by 1.7% per annum over 2011–19 or by 2.1% per annum over 2015–19.

This lack of trend in death rates means that the positive trends in the number of deaths must be from higher population not from rising individual-level risk of death for the average person. Notably, there are statistically significant negative time trends in death rates *within* each age group in the 2011–19 period (and in two of the older age groups in 2015–19). Hence, the lack of trend in death rates for the all-ages aggregate is due to offsetting effects: a rising share of the population are in the higher risk age group of 65 and above (who comprise 80% of all deaths over this period) – a between group effect – but this is offset by declining death rates within age groups.[11] In other words, population aging (the increasing share of the population in the older age groups) did not increase the individual-level risk of death. Instead, the annual trend rate of increase of 1.7% (2.1%) in the total number of deaths over 2011–19 (2015–19) is just because New Zealand had more people available to die rather than to a rise in the average death rate.

If societal aging was a cause of the increased number of deaths, as Gabel and Knox (2023) put forward as a reason for the excess mortality in 2022, it should also show up prior to the COVID-19 era, given that societal aging is a long-term process. Moreover, societal aging should show up in terms of higher overall death rates (as more of the population are in the age-groups, such as the 65 years and above, where death rates are higher). Yet there was no trend in death rates for all-ages, in either the 2011–19 or 2015–19 periods, so importance of societal aging as a driving force for markedly higher total deaths in 2022 should not be emphasized. The fact that two of the within-group trends lose statistical significance when the sample period shifts from 2011–19 to 2015–19 suggests that caution is needed in extrapolating forward into the future from these short time periods. Nevertheless, using the most detailed data available, on weekly deaths by age group for the longest possible sample, there is good reason to believe that the rise in the total number of deaths in New Zealand from 2015–19 (or from 2011–19) was simply due to there being more people available to die, rather than to a rise in the individual-level death rate.